

# COMMENTARY ON THE MISTLETOES OF PANAMA<sup>1</sup>

JOB KUIJT<sup>2</sup>

## ABSTRACT

An updated listing is provided for Panamanian genera and species of Loranthaceae (*Cladocolea*, *Gaiadendron*, *Oryctanthus*, *Phthirusa*, *Psittacanthus*, *Struthanthus*, and possibly *Ixocactus*), Viscaceae (*Dendrophthora*, *Phoradendron*), and Eremolepidaceae (*Antidaphne*). Aside from certain nomenclatural changes, new records from Panama are: *Cladocolea oligantha* (Standley & Steyermark) Kuijt, possibly *Ixocactus hutchisonii* Kuijt, *Phoradendron annulatum* Oliver, *P. crassifolium* (Pohl) Eichler, *P. dichotomum* (Bertero) Krug & Urban, *P. dipterum* Eichler, *P. quadrangulare* (H.B.K.) Krug & Urban, *P. robustissimum* Eichler, *Psittacanthus nodosus* (Desr.) G. Don, *Struthanthus quercicola* (Cham. & Schlecht.) Blume, and *S. aff. dichotrianthus* Eichler. In addition, the following new species are described: *Dendrophthora panamensis* Kuijt, *Psittacanthus hamulifer* Kuijt, and *P. pusillus* Kuijt. Six further species are recognized but remain unnamed because of difficulties inherent in *Phoradendron*, raising the total number of Panamanian mistletoes to at least 45 species.

In the years since Rizzini's (1960) treatment of the mistletoes of Panama appeared, various new points of view have arisen with regard to some of his interpretations, and numerous new relevant facts have emerged. The following is offered as a series of emendations.

Perhaps the most important broader change which has occurred in the intervening years is the acceptance of two or even three separate mistletoe families (Barlow, 1964; Kuijt, 1968). All three of these families are represented in Panama, Eremolepidaceae (*Antidaphne*), Viscaceae (*Dendrophthora*, *Phoradendron*), and Loranthaceae, s.s. (*Cladocolea*, *Gaiadendron*, *Oryctanthus*, *Phthirusa*, *Psittacanthus*, *Struthanthus* (incl. "*Phrygilanthus*" *panamensis*) and possibly *Ixocactus*. My present comments, however, are organized in an alphabetical fashion. In all cases, this commentary applies to a Panamanian context, its usefulness to adjacent geographic areas being untested. For species merely listed below, the reader is referred to the critical literature cited under each genus.

## KEY TO THE GENERA OF PANAMANIAN MISTLETOES

- a. Phyllotaxy alternate throughout.
  - b. Flowers with conspicuous, aborted organs of the opposite sex; spikes lacking distal leafy organs; petals conspicuous, 4; style at least 4 mm long ..... 2. *Cladocolea*
  - bb. Flowers lacking aborted organs; pistillate spikes normally with small, distal leaves which may expand into full size after flowering; petals 2(3), lacking in staminate flowers, less than 0.5 mm in the pistillate flowers; style less than 1 mm long ..... 1. *Antidaphne*
- aa. Phyllotaxy decussate or whorled.
  - c. Flowers single (not in diads, triads, or longitudinal series), individually in axillary positions on the main stem, on spikes, or on racemes.

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<sup>2</sup> Department of Biological Sciences, University of Lethbridge, Lethbridge, Alberta, Canada T1K 3M4.

- d. Inflorescence lacking, the flowers 1–several per leaf axil; plants squamate, the young stems obviously compressed ... 5. *Ixocactus* (included tentatively only)
- dd. Inflorescence a raceme or spike; plants leafy, the stems terete or slightly compressed.
  - e. Inflorescence a spike, the flowers or fruits sessile, often in depressions, always flanked by 2 minute, separate bracteoles; flowers less than 5 mm long ..... 6. *Oryctanthus*
  - ee. Inflorescence a raceme, the individual flowers pedicellate, the pedicel supporting a bract and 2 fused bracteoles; flowers more than 8 mm long ..... 10-5. *Struthanthus panamensis* (Rizz.) Barlow & Wiens
- cc. Flowers sessile above bracts, usually in longitudinal series, or in diads or triads.
  - f. Flowers sessile in depressions above the inflorescence bracts, always lacking individual bracteoles, and never in diads or triads; plants squamate or leafy.
    - g. Anthers unilocular; plants squamate or leafy; flowers in single or multiple series above the bracts ..... 3. *Dendrophthora*
    - gg. Anthers bilocular; plants leafy; flowers always in multiple series above the bracts ..... 7. *Phoradendron*
  - ff. Flowers and/or triads (diads) stalked, not in depressions, the flowers always with individual bracts or bracteoles; plants leafy.
    - h. Plants dioecious, the flowers with aborted stamens or style.
      - i. Filaments thin; inflorescence a simple raceme ..... 10. *Struthanthus*
      - ii. Filaments stout, the upper ones with lateral depressions; inflorescence a panicle ..... 8-1. *Phthirusa adunca* (Meyer) Maguire
    - hh. Plants with the flowers hermaphroditic.
      - j. Flowers golden yellow, subtended by green leafy bracts; parasites or seemingly epiphytes on tree branches, or terrestrial ... 4. *Gaiadendron*
      - jj. Flowers at least partly red or orange, not subtended by leafy bracts; parasites on tree branches.
        - k. Flowers less than 4 mm long; epicortical roots from base of plant; fruit with endosperm ..... 8-2. *Phthirusa pyrifolia* (H.B.K.) Eichler
        - kk. Flowers more than 10 mm long; epicortical roots lacking; fruit without endosperm ..... 9. *Psittacanthus*

1. ANTIDAPHNE Poepp. & Endl., Nov. Gen. & Sp. Pl. 2: 70, *tab.* 199. 1838.

The genus and two others not occurring in Central America (*Eremolepis* and *Eubrachion*) have been placed in a separate family, Eremolepidaceae. The species below, the only one in Central America, ranges from Mexico and Guatemala into South America.

Critical literature: Rizzini, 1956; Kuijt, 1964, 1968.

1. *Antidaphne viscoidea* Poepp. & Endl., Nov. Gen. & Sp. Pl. 2: 70, *tab.* 199. 1838.

This is the only species of the genus in Panama. The following are recent collections.

CHIRIQUÍ: Slopes on Cerro Horqueta, 1650 m, *Croat* 26950 (MO). Lava fields near Volcán, 4600 ft, *Duke* 9178 (MO). 1 mi from El Volcán, *Ebinger* 774 (MO). 3 km NW of Boquete, 1320 m, *Nee* 10627 (MO). Roadsides S of Boquete, 1050–1100 m, *Nee* 10647 (MO). 1 km NE of El Hato del Volcán, 1440 m, *Nee* 14128 (MO). S side of El Hato del Volcán, 1390 m, *Nee* 14147 (MO). DARIÉN: Summit of Pico Tacarcuna, 1850 m, *Gentry et al.* 16904 (MO). PANAMÁ: Road from El Llano to Cartí-Tupile, 12 km above Pan-Am. Highway, 200–250 m, *Croat* 22906 (MO).

2. CLADOCOLEA Van Tieghem, Bull. Soc. Bot. France 42: 166. 1895.

Erect or scandent *parasitic shrubs*, glabrous or short-pubescent; lateral branches (including inflorescences) often emerging in a pseudo-endogenous fashion; epicortical roots on stems or at the base of the plant or absent. *Leaves* decussate, alternate, or irregularly arranged, simple, with pinnate venation, sometimes reduced to scales. Plants *dioecious* or with *flowers hermaphroditic*; in the former case aborted organs of the opposite sex usually present. *Inflorescence* normally a determinate spike, capitulum, dichasium, or raceme, in some species having undergone loss of the terminal flower or having been reduced to a single flower with 1 pair of bracts; lateral flowers ebracteolate, single in the axils of squamate (sometimes caducous) or foliaceous bracts. *Flowers* pale green to pale yellow, sessile or pedicellate, 4-, 5-, or 6-partite; stamens fused with the perianth members, dimorphic or monomorphic, with 4 thecae; pollen rounded triangular, sometimes with a triradiate groove and included triangular prominence, otherwise smooth; style often contorted or geniculate, especially in the upper portion. *Fruit* a 1-seeded berry with endosperm; embryo dicotyledonous, elongate, or globular, the haustorial disc weakly developed.

This generic name has lain dormant since 1895 and has recently been revived to accommodate various species assigned to *Struthanthus*, *Phthirusa*, and *Oryctanthus*, plus a number of previously undescribed species, making a total of 23 species. Most of these species are found in Mexico but a few are South American. *Cladocolea oligantha*, however, is Guatemalan except for the remarkable disjunct population represented by the two collections below. Most members of the genus are characterized by a determinate spike of sessile, ebracteolate flowers. In the case of the Panamanian species the spike is reduced to three flowers, but the spikes occur in two slightly different forms, depending upon the age of the branch supporting them. The type of *C. oligantha* is from Guatemala.

Critical literature: Kuijt, 1975.

1. ***Cladocolea oligantha*** (Standley & Steyermark) Kuijt, J. Arnold Arbor. 56: 317. 1975.

*Struthanthus oliganthus* Standley & Steyermark, Publ. Field Mus. Nat. Hist., Bot. Ser. 23: 154. 1944.

Plants *dioecious*, sparsely branched, completely glabrous, with sympodial growth; stems rather stout and straight, terete, first light colored, later dark brown and often with a sprinkling of rather large, transverse lenticels; 1-year-old wood (bearing secondary inflorescences) with shrunken bark, as if cortex very fleshy; no basal or stem roots seen. *Leaves* alternate, 20–30(–45) mm long, 8–10(–16) mm wide, lanceolate to oblanceolate, acute to rounded at the apex, long-tapering at the base into a petiole 2–4 mm long and 0.5–2 mm thick; mid-vein running into the apex, other veins often obscure, pinnate except for 2 large, basal lateral veins running halfway down the length of the blade. *Inflorescences* of 2 types: (1) primary, on current year's growth, mostly single (rarely with a superposed inflorescence), axillary, simple dichasia on peduncles 4–5(–10) mm long and 1 mm thick, the bracts of 2 lateral flowers caducous, the 3 flowers

in one plane; and (2) secondary, developing on year-old growth, bearing 1 or 2 small but normal foliage leaves at the very base, deceptively like primary leaves, the flowers 4–6, one of which is terminal, the others crowded nearby, spirally arranged. *Flowers* said to be reddish, ca. 5 mm long and 2 mm wide when in (clavate) bud, tetramerous; anthers 1.5 mm long, inserted in the middle of the petals, with projecting connective and 4 pollen sacs; stamens and petals monomorphic; style straight or nearly so, at least 4 mm long, the stigma inconspicuous. *Fruit* red, becoming black, 7 mm long, 5 mm wide, ovoid, smooth; embryo dicotyledonous, nearly 4 mm long, clavate.

PANAMÁ: Vicinity of Las Lajas bridge, Panama National Highway, *Bartlett & Lasser 16645* (MO). Near beach at Nueva Gorgina, on *Bursera tomentosa*, *Duke 4504* (GH, MO, US).

### 3. DENDROPHTHORA Eichler, Fl. Bras. 5(2): 102. 1868.

The genus is distinguished from *Phoradendron* by its unilocular anthers (*Phoradendron* has bilocular ones). This distinction is inconvenient but apparently consistent. It should be mentioned that the statement "cataphylls poorly developed" in the earlier Panamanian treatment is unreliable by way of a generic feature, as many *Dendrophthora* species have cataphylls (for example, all Panamanian species but *D. squamigera*). A fifth species, *D. ambigua* Kuijt (Kuijt, 1961b) may be expected in Panama, as it occurs both in Costa Rica and in Colombia-Ecuador. As in the case of others, it may easily be confused with *Phoradendron* spp.; however, it has a uniquely variable inflorescence type (Kuijt, 1961b, 1964).

Critical literature: Kuijt, 1961b, 1963b, 1964.

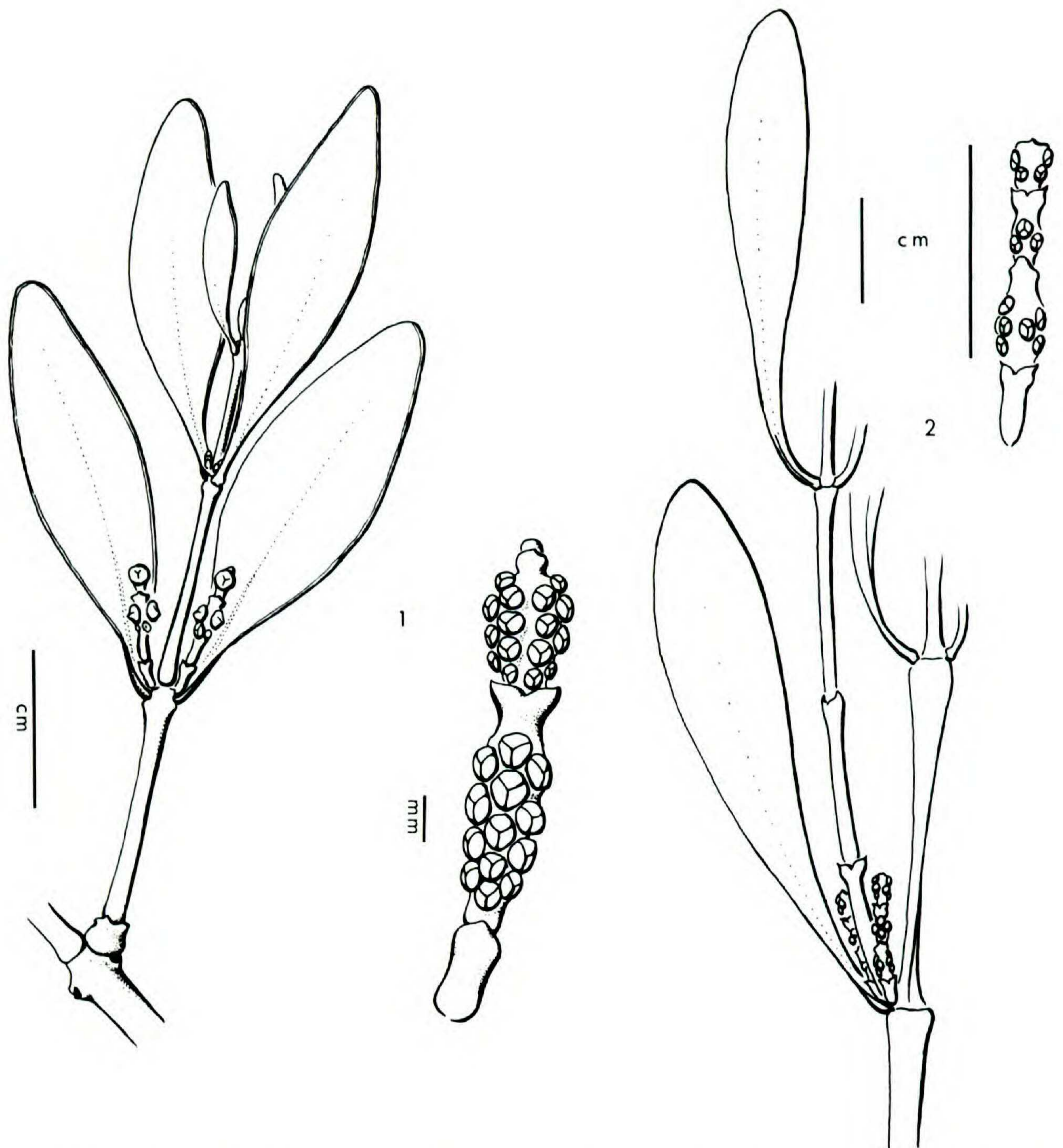
- a. Plants leafy; flowers in 3 series above each fertile bract (except sometimes the small, terminal internodes); inflorescence with 2–3 fertile internodes.
- b. Plants monoecious; leaves broadly obovate; flowers more than 6 per bract ..... 1. *D. costaricensis* Urban
- bb. Plants dioecious; leaves lanceolate to rhombic or spatulate; flowers fewer than 6 per bract in *female plants only*.
- c. Lateral branches usually with 2 pairs of widely spaced basal cataphylls at least 7 mm from each other or above the axil; young stems compressed, with ridges ..... 4. *D. sp.*
- cc. Lateral branches with 1 (rarely 2) pairs of basal cataphylls less than 5 mm from each other or above the axil; young stems more or less terete, lacking ridges ..... 2. *D. panamensis* Kuijt
- aa. Plants squamate, olive green to brown; flowers in a single series above each fertile bract; inflorescence usually with a single fertile internode ..... 3. *D. squamigera* (Benth.) Kuntze

### 1. *Dendrophthora costaricensis* Urban, Ber. Deutsch. Bot. Ges. 14: 285. 1896.

*Phoradendron allenii* Trelease, Ann. Missouri Bot. Gard. 27: 307. 1940.  
*P. crispum* Trelease, Gen. Phor. 17. 1916.

### 2. *Dendrophthora panamensis* Kuijt, sp. nov.—FIG. 1.

Frutex glaber, ramosissimus, dioecus; internodia novella superne pauce applanata, inferne quadrangularia; rami laterales cataphyllis basalibus uni-(raro bi-)jugis, 2 ad 3 mm supra axillam



FIGURES 1-2.—1. *Dendrophthora panamensis* Kuijt, the (pistillate) type at left (Liesner 1305), a staminate spike at right (Mori, Kallunki & Gentry 4703).—2. *Dendrophthora* sp. No. 4 (Croat 26949).

positis. Folia rhomboidea ad lanceolata, usque ad  $4 \times 1.5$  cm. Spica pistillata 1-1.5 cm longa, internodio sterili singulo, fertilibus tribus, floribus ternis pro bractea. Fructus baccatus, paulum compressus, circ. 2 mm diam. Spica staminata similis sed floribus pro bractea fertili usque ad 14.

Glabrous, much branched (percurrent) and brownish green *mistletoes*, the young internodes somewhat flattened above and slightly quadrangular below, soon becoming terete; lateral branches with one pair of inconspicuous, very basal cataphylls, sometimes followed by a second several mm higher. *Leaves* thin, to 4 cm long and 1.5 cm wide, thin, rhombic to lanceolate, with clearly defined

callused margin, the apex acute to rounded, the base cuneately tapered into a petiole about 3 mm long. *Dioecious*. *Pistillate spike* 1–1.5 cm long, slender, with 1 sterile internode and 3 fertile ones, the latter with ca. 3 flowers per bract (1 flower per bract on the terminal internode) on the distal portion of the internode. *Fruit* a compressed berry 2 mm in diameter. *Staminate spike* of similar size and composition, but with up to 14 orange yellow flowers per fertile bract in 1b arrangement (cf. Kuijt, 1963b), and sometimes a second sterile internode; anther bean shaped, unilocular, less than 0.5 mm long.

This is an inconspicuous species easily mistaken for a *Phoradendron*, but with clearly unilocular (though extremely small) anthers. *Dendrophthora panamensis* is a member of the *D. costaricensis* group of subgenus *Paradendrophthora*, as also indicated by the flattened berries which occur only in that subgenus (Kuijt, 1961b, 1964).

TYPE: PANAMA. SAN BLAS: Primary forest along newly cut road from El Llano to Cartí-Tupile, continental divide to 1 mi from divide, 300–500 m, *Liesner 1305* (MO, holotype; LEA, isotype).

Other material examined: PANAMÁ: El Llano-Cartí Road, 12.7 km from Inter-American Highway, wet forest, 350 m, *Mori, Kallunki & Gentry 4703* (MO, LEA).

3. ***Dendrophthora squamigera*** (Benth.) Kuntze, *Rev. Gen.* 2: 505. 1891.

*D. biserrula* Eichler, *Fl. Bras.* 5(2): 104. 1868.

4. ***Dendrophthora* sp.**—FIG. 2.

Much branched, stiffly erect *shrub* with internodes to 4 cm long, compressed, with 2 sharp ridges, becoming terete in age; percurrent branches without cataphylls; lateral branches with 2 (rarely 1) pairs of cataphylls widely spaced, the lowest 7–20 mm above axil, the second pair somewhat more above the first pair. *Leaves* narrowly spatulate, to 6 cm long and 1.5 cm wide, with long-tapering bases and obtuse apices. *Spikes* 1 per axil, or 2 flanking each lateral branch, to 2.5 cm long with 3–4 fertile internodes, basal cataphylls lacking (rarely with 1 pair), 3–4 flowers per bract in 3 series in the middle of fertile internodes, the terminal internode very blunt.

The absence of anthers deprives us of proof that this indeed is a *Dendrophthora* rather than a *Phoradendron*; the plant is pistillate with nearly mature spikes. However, its general appearance, especially the widely spaced, usually double set of basal cataphylls, suggests a *Dendrophthora*. Even if it is, it may easily already have received a name under *Phoradendron*, and it seems better simply to draw attention to it.

CHIRIQUÍ: In and along wooded slopes on Cerro Horqueta, 1650 m, *Croat 26949* (MO).

4. **GAIADENDRON** G. Don, *Gen. Syst.* 3: 431. 1834.

1. ***Gaiadendron punctatum*** (Ruiz & Pavón) G. Don., *Gen. Syst.* 3: 431. 1834.

*G. poasense* Donnell Smith, *Bot. Gaz.* (Crawfordsville) 56: 61. 1913.

Rizzini's suggestion that *Gaiadendron* must probably be returned to *Phrygilanthus* sensu Eichler has not been supported by subsequent work. Barlow & Wiens (1973) have shown *Phrygilanthus* to be a very heterogenous group which cannot be retained as such. *Gaiadendron* according to Barlow & Wiens is best treated as a monotypic genus with a single polymorphic species, *G. punctatum*. Whether or not this is a defensible view, all Central American material is clearly referable to *G. punctatum*. It is of some interest that in this area the species occurs both at the diploid and tetraploid levels (Barlow & Wiens, 1971). The genus has hermaphroditic flowers, my previous description of *G. punctatum* as a monoecious species (Kuijt, 1964) being in error.

Critical literature: Barlow & Wiens, 1971, 1973; Kuijt, 1963a, 1964.

5. IXOCACTUS Rizz., Arch. Jard. Bot. Rio de Janeiro 12: 118. 1952.

1. *Ixocactus hutchisonii* Kuijt, Brittonia 19: 62. 1967.

A small, olive green, squamate *shrub* with decussating, minute scale leaves, the internodes to 7 cm long, much compressed, oblong to somewhat rhombic; lateral branches (or flowers) at most 5 per axil. *Flowers* perfect, 2 mm long and 1 mm thick in bud; petals 4 (3), broadly oval, each with a sessile anther provided with 2 minute pollen sacs dehiscing longitudinally, the pollen sacs with no more than 30 grains each, the anthers (sometimes pollen sacs of a single anther) often at different heights, at least in tetramerous flowers, the pollen commonly quadricolpate with a dense covering of stout spines and four conspicuous, longitudinal colps; style bluntly conical, persistent, the stigma capitate. *Fruit* an oval berry, at least 3.5 mm long and 2 mm thick.

This striking monotypic genus has so far been known only from two collections from Venezuela and Colombia. In the Stockholm Herbarium, however, there exists an early collection of *I. hutchisonii* apparently from Panama. The accompanying data are, unfortunately, very scanty: N. J. Andersson, Panama, April 1852. There are two separate sheets. Dr. Benkt Sparre, Curator of the Regnellian Herbarium, confirms that Andersson was indeed in Panama in April, 1852, but that Andersson was a rather careless collector. The possibility that material from the previous collecting area (Isla Puna outside Guayaquil in Ecuador) was inadvertently labelled "Panama" can be neither excluded nor confirmed. It is also known that Andersson visited the Pearl Islands (Panama) at about this time, but his diary provides no further information on the matter. I feel there is no alternative but to add *Ixocactus* to the *Flora of Panama*, even though on a tentative basis only. The brief description is taken from Kuijt (1967) where illustrations may also be found.

6. ORYCTANTHUS Eichler, Fl. Bras. 5: 87. 1868.

This genus has recently been monographed, resulting in a number of nomenclatural and taxonomic changes from both Rizzini's (1960) treatment of Panama and mine (Kuijt, 1964) for Costa Rica, as indicated below.

Critical literature: Kuijt, 1961a, 1976a.

- a. Flowers and fruits perpendicular to the inflorescence axis.
  - b. Stems terete even when young ..... 3. *O. occidentalis* (L.) Eichler
  - bb. Stems strongly compressed or angular when young ..... 2. *O. cordifolius* (Presl) Urban
- aa. Flowers and fruits inclined forward.
  - c. Plants small; leaves petiolate, rather thin, the midrib running into the leaf apex; stems angular and with furfuraceous lines when young; spikes slender, always with a distinct peduncle, never in terminal compound groups ..... 4. *O. spicatus* (Jacq.) Eichler<sup>3</sup>
  - cc. Plants coarse; leaves short-petiolate or clasping, leathery, the midrib (if visible) not running into the apex; stems terete, with a general (not lined) furfuraceous covering when young; spikes stout, with a thick peduncle or nearly sessile, axillary, in some also in terminal compound groups ..... 1. *O. alveolatus* (H.B.K.) Kuijt

1. ***Oryctanthus alveolatus***<sup>4</sup> (H.B.K.) Kuijt, Bot. Jahrb. Syst. 95: 504. 1976.

*Loranthus alveolatus* H.B.K., Nov. Gen. Sp. Pl., Quarto text, 3: 444. 1820.

*Oryctanthus amplexicaulis* (H.B.K.) Eichler, Fl. Bras. 5(2): 88. 1868.

*O. botryostachys* Eichler, Fl. Bras. 5(2): 89. 1868.

This is a widespread and taxonomically difficult complex which in past works has been referred to as *O. amplexicaulis* and *O. botryostachys* in Central America and parts of South America. It may well be that two such variants (one amplexicaul and with terminal compound inflorescences, the other petioled and with only axillary spikes) warrant some subspecific status in the area, but at present such a delimitation is impossible in South America. It should be noted that Rizzini (1960) used the name *O. spicatus* with reference to the second variant, known elsewhere as *O. botryostachys*.

2. ***Oryctanthus cordifolius*** (Presl) Urban, Bot. Jahrb. Syst. 24: 30. 1898.

This is an easily recognized species by its combination of large, clasping leaves and sharp-angled stems.

3. ***Oryctanthus occidentalis*** (L.) Eichler, Fl. Bras. 5(2): 89. 1868.

Frequently confused with some plants of *O. alveolatus*, and more rarely *O. cordifolius*, *O. occidentalis* nevertheless does not intergrade with these species, and can always be identified when using the keys consistently. The species has a parallel geographic range and taxonomic complexity as compared to *O. alveolatus*, but also occurs on Jamaica.

4. ***Oryctanthus spicatus*** (Jacq.) Eichler, Fl. Bras. 5(2): 89. 1868.

Notwithstanding inclusion of this name in Rizzini's (1960) treatment (see above under *O. alveolatus*), authentic *O. spicatus* material does not seem to have been collected yet from Panama. This is surprising since its total geographic range stretches from Guatemala to Peru, the species being especially

<sup>3</sup> See note under *O. spicatus*.

<sup>4</sup> For further synonymy, see Kuijt (1976a).



common in both Costa Rica and Colombia. As it seems reasonable to expect this inconspicuous mistletoe at least in the mountainous northerly portions of Panama, it is here tentatively included.

7. *PHORADENDRON* Nuttall, J. Acad. Nat. Sci. Philadelphia, ser. 2, 1: 185. 1847.

I am disappointed to find that I can no more construct a key to Panamanian *Phoradendron* than I can identify several unnamed species—and for very similar reasons. The distinctions between *P. quadrangulare* and the almost exclusively Caribbean *P. trinervium*, for example, need first to be clarified, and I am presently not in a position to do this.

Critical literature: Kuijt, 1959; Trelease, 1916, 1940.

1. *Phoradendron acinacifolium* Eichler, Fl. Bras. 5(2): 117. 1868.

*Phoradendron robaloense* Woods. ex Rizz., Ann. Missouri Bot. Gard. 47: 282. 1960.

Although the two collections below correspond to Costa Rican plants (Kuijt, 1964), the specific epithet here used belongs to Brazilian material, and is possibly inappropriate.

CHIRIQUÍ: Bajo Mona, Robalo Trail, 1500–2100 m, Allen 4838 (MO, holotype of *P. robaloense*). COLÓN: East ridge, Duke 15274 (MO).

2. *Phoradendron angustifolium* (H.B.K.) Nuttall, J. Acad. Nat. Sci. Philadelphia, ser. 2, 1: 185. 1847.

*Viscum stenophyllum* Spreng., Syst. Veg. 1: 487. 1825, non *Phoradendron stenophyllum* Trelease, Gen. Phor. 81. 1916.

*Loranthus angustifolius* H.B.K., Nov. Gen. Sp. Pl. 3: 442. 1820.

*Viscum angustifolium* (H.B.K.) DC., Prodr. 4: 281. 1830.

*V. ensifolium* Pohl in DC., Prodr. 4: 281. 1830.

*Phoradendron ensifolium* (Pohl) Nuttall, J. Acad. Nat. Sci. Philadelphia, ser. 2, 1: 185. 1847.

*P. corynarthron* Eichler, Fl. Bras. 5: 115. 1868.

*P. cooperi* Trelease, Gen. Phor. 67. 1916.

?*P. pringlei* Trelease, Gen. Phor. 60. 1916.

*P. tonduzii* Trelease, Gen. Phor. 67. 1916.

*P. dodgei* Trelease, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 405. 1937.

*P. davidsoniae* Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 17. 1940.

*P. novae-helveticae* Trelease, Ann. Missouri Bot. Gard. 27: 307. 1940.

As visualized here, we are concerned with a not exceptionally polymorphic species ranging from Costa Rica into Peru, Bolivia, and Brazil. The variability in leaf width and length, but also in flower seriation, has brought about the excessive synonymy above.

3. *Phoradendron annulatum* Oliver, Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1864: 176. 1865.

See comments under No. 19.

CHIRIQUÍ: Boquete District, Volcán de Chiriquí, 10,000 ft. Davidson 996 (F).

4. **Phoradendron crassifolium** (Pohl) Eichler, Fl. Bras. 5(2): 125. 1868.

The species is unmistakable because of the production of spikes in the axils of intercalary cataphylls (Kuijt, 1959), a feature not found in any other Central American mistletoe. Superficially, the species resembles *P. woodsonii* and species No. 18 where intercalary cataphylls are always sterile.

CANAL ZONE: 5 mi N of Gamboa, *Lazor & Blum* 5333 (DUKE, MO). CHIRIQUÍ: Volcán, *Croat* 10425 (DUKE, MO). Cerro Hornitos, 40 km NW of Gualaca, 2238 m, *Mori & Bolten* 7512 (MO). COLÓN: Santa Rita Ridge, *Foster* 1720 (DUKE). DARIÉN: El Real, *Burch et al.* 1060 (DUKE, MO). Forest near Pidique Peak, 800–1000 ft, *Duke* 8070 (MO). PANAMÁ: Camino a Chepo, *Correa et al.* 996 (DUKE, MO). Cerro Jefe, 2100–2200 ft, *Duke* 15222 (MO). Cerro Azul, *Dwyer* 1382, 2068 (both MO). Cerro Jefe, 800–1000 m, *Gentry* 2888 (MO). Punta de Cerro Jefe, *Gómez-Pompa et al.* 3081 (MO). 16–20 km above Pan-Am. Highway on road from El Llano to Cartí-Tupile, 400 m, *Kennedy* 2702 (MO). Road past Cerro Azul 20 km from junction with road through Tocumen, *Mori & Kallunki* 2210 (MO). VERAGUAS: Isla de Coiba, *Dwyer* 2337 (MO).

5. **Phoradendron dichotomum** (Bertero) Krug & Urban, Bot. Jahrb. Syst. 24: 48. 1897.

Assignment of the two specimens cited below to *P. dichotomum* is tentative. They are both unusually stout as compared with Costa Rican material, the leaf pairs of the second collection 20 cm apart, and the leaves rather leathery. The same specimen is clearly staminate, while Costa Rican material was thought to be monoecious (Kuijt, 1964). In all other respects, especially the terminal spikes which as a regular feature are not known from other Central American species, the plants correspond to *P. dichotomum*. See the discussion in Kuijt (1964) of the geographical range of this mistletoe.

PANAMÁ: El Llano-Cartí road, 12.7 km from Inter-American Highway, on melastome, 350 m, *Mori et al.* 4678 (MO). VERAGUAS: 5 mi W of Santa Fé, 800–1200 m, *Croat* 23055 (MO).

6. **Phoradendron dipterum** Eichler, Fl. Bras. 5(2): 109. 1868.

This is an interesting species, here reported from Panama for the first time, thus linking South American collections with those from Costa Rica and further north (Kuijt, 1964). Panamanian material is similar to that from Costa Rica in having stems quadrangular rather than winged, but it differs somewhat in that the leaves are not clasping, and the spikes are rather small.

LOS SANTOS: Poci, *Dwyer* 2518 (MO).

7. **Phoradendron flavens** (Swartz) Griseb., Fl. Brit. W. I. 33. 1864.

*P. quinquenervium* Krause, Notizbl. Königl. Bot. Gart. Berlin 5: 264. 1912.

*P. supravenulosum* Trelease, Gen. Phor. 154. 1916.

See the discussion under *P. flavens* in Kuijt (1964).

8. **Phoradendron mucronatum** (DC.) Krug & Urban, Bot. Jahrb. Syst. 24: 352. 1897.

9. **Phoradendron obliquum** (Presl) Eichler, Fl. Bras. 5(2): 134. 1868.

Having studied the type material at Prague (*Haenke s.n.*, from Peru), I no longer doubt that Central American plants are conspecific with it. In particular, the type appears to have flowers of both sexes on the same spike, rendering it monoecious as the plants in Costa Rica (Kuijt, 1964) and Panama.

CANAL ZONE: 12 mi N of Gamboa, on *Xanthoxylum belizensis* Lundell, *Tyson* 6653 (MO). 4 km NW of Gamboa, 50 m, *Nee* 7540 (MO). DARIÉN: Vicinity of El Real along road to airport, on *Xanthoxylum*, *Croat* 15443 (MO). PANAMÁ: Vicinity of El Llano, on *Vitex*, *Duke* 5796 (MO). Cerro Jefe, 2700–3000 ft, *Tyson et al.* 3282 (MO).

10. **Phoradendron piperoides** (H.B.K.) Trelease, Gen. Phor. 145. 1916.

11. **Phoradendron quadrangulare** (H.B.K.) Krug & Urban, Bot. Jahrb. Syst. 24: 35. 1897.

*P. ceibanum* Trelease, Gen. Phor. 110. 1916.

*P. rensonii* Trelease, Gen. Phor. 105. 1916.

*P. venezuelense* Trelease, Gen. Phor. 111. 1916.

*P. paquitatum* Trelease, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 405. 1937.

*P. corynarthron* Eichler var. *seibertii* Trelease, Ann. Missouri Bot. Gard. 24: 187. 1937.

*P. seibertii* Rizz., Ann. Missouri Bot. Gard. 47: 285. 1960.

Consistent application of the concept of *P. quadrangulare* as employed by Standley & Steyermark (1946) in the *Flora of Guatemala* results in at least the above synonyms from Costa Rica and Panama. Undoubtedly, more synonyms will accrue when this difficult species can be surveyed as a whole, as indicated in the further synonyms in Standley & Steyermark (1946) and Rizzini (1960). Only a few representative collections from Panama are listed below; the species may be expected at lower elevations throughout Panama.

BOCAS DEL TORO: Hill above RR station at Milla 7.5, an *Cassia reticulata*, *Croat & Porter* 16364 (MO). CANAL ZONE: Diablo Heights, 10 m, *Nee* 11151 (MO). 1.5 km SE of Pedro Miguel, 15 m, *Nee* 10192 (MO). Just inland from Playa Kobbe, *Wilbur & Teeri* 12993 (DUKE). PANAMÁ: Cerro Jefe, 2900 ft, *Dwyer & Hayden* 8080 (MO, LEA). VERAGUAS: Road between San Francisco and Santa Fé, *Stern et al.* 1929 (MO).

12. **Phoradendron robustissimum** Eichler, Fl. Bras. 5(2): 122. 1868.

*P. pergranulatum* Trelease, Ann. Missouri Bot. Gard. 27: 308. 1940.

This species has previously been reported from Venezuela, from Costa Rica to southern Mexico (Kuijt, 1964), and (as *P. pergranulatum* Trelease, based on a single specimen) from Panama. The latter specimen is clearly dichotomous as Costa Rican plants, but the others here cited also (or only) show percurrent branching.

CHIRIQUÍ: 1½ km NW of Boquete on road to El Salto, 1280 m, *Nee* 10655 (MO, LEA). COCLÉ: El Valle, 800–1000 m, *Allen* 777 (ILL, type of *P. pergranulatum* Trelease). El Valle de Antón, 1000–2000 ft, *Lewis et al.* 2571 (MO, LEA). LOS SANTOS: 7 mi S of Las Tablas, *D'Arcy & Croat* 4204 (MO). PANAMÁ: 7 mi S of Campana, 3–30 m, *McDaniel* 8335 (DUKE).

13. **Phoradendron trinervium** Griseb., Fl. Brit. W. I. 314. 1860.

14. **Phoradendron undulatum** Eichler, Fl. Bras. 5(2):122. 1868.

*P. gracilispicum* Trelease, Gen. Phor. 130. 1916.

Trelease (1916) mentions two further specimens from Chiriquí (*Pittier* 2932, 3312) which I have not seen.

CHIRIQUÍ: Lava fields 2.2 mi E of Hato del Volcán, *Luteyn* 810 (DUKE, MO).

15. **Phoradendron woodsonii** Trelease, Ann. Missouri Bot. Gard. 27: 308. 1940.

A rather small species; stems terete, the percurrent internodes with 2–4 pairs of sterile intercalary cataphylls. *Leaves* to 5.5 cm long and 2.5 cm wide, ovate to lanceolate, the margin callused, the base tapering into a short stout petiole. *Spikes* clustered at leafy nodes, ca. 5 cm long, consisting of 5 or 6 fertile and 2 or 3 sterile, short internodes. *Flowers* in 3 series above each bract, ca. 9 per bract, and near the middle of the internode, the terminal internode reduced and sharply pointed. *Fruit* short-ovate, ca. 2 mm thick, the petals closed.

This species is closely related to the unnamed species No. 18, but differs as there specified. Other near relatives are *P. crassifolium* and *P. piperoides*. Previously it was known from the type collection only.

CHIRIQUÍ: Cerro Hornitos, 40 km NW of Gualaca, 2238 m, *Mori & Bolten* 7512 (MO). 3 km N of El Volcán, 5000 ft, *Tyson* 5727 (MO). COCLÉ: Between Las Margaritas and El Valle, *Woodson et al.* 1302 (ILL, type). PANAMÁ: La Campana, Cerro Campana, *Duke* 10743 (MO, OS); *Ebinger* 343 (MO). Road from Cerro Azul to Cerro Jefe, 2300–2700 ft, *Tyson* 4312 (MO).

16. **Phoradendron** sp.—FIG. 3.

Light green plants; stems straight, terete, forking through formation of terminal spikes; lateral stems with 3 or 4 pairs of basal cataphylls mostly crowded at the base. *Leaves* to 8 cm long and 3.5 cm wide, palmate venation apparent on both surfaces, obovate to spatulate, the apex obtuse to emarginate, the base cuneately tapering to a short, stout petiole about 3 mm long. *Dioecious*; only pistillate plants seen. *Pistillate spikes* terminal and axillary, with very short sterile internodes and 3–4 fertile ones, each spike up to 2 cm long. *Flowers* mostly one above each bract but sometimes 2–5 in 1b (cf. Kuijt, 1963b) arrangement, or with 2 flowers very nearly above each other; petals and berries orange, ovate, at least 2 mm wide and 4 mm long when dry with closed petals, the base sunken in a conspicuous floral cup.

This species does not seem to be included in Trelease's (1916) monograph but may have been published subsequently. It is distinctive in its terminal spikes and forking habit, and in the flower position which sometimes mimics the 2a type (cf. Kuijt, 1963b) which is restricted to *Dendrophthora*. In the present species the two flowers which follow the apical one above each bract apparently are often reduced to a single one, and this one very nearly occupies a median position (Fig. 3, lower left). Although technically it cannot be established that the species is correctly assigned to *Phoradendron* (the collections are pistillate, and the generic distinction from *Dendrophthora* relies mostly on anther struc-

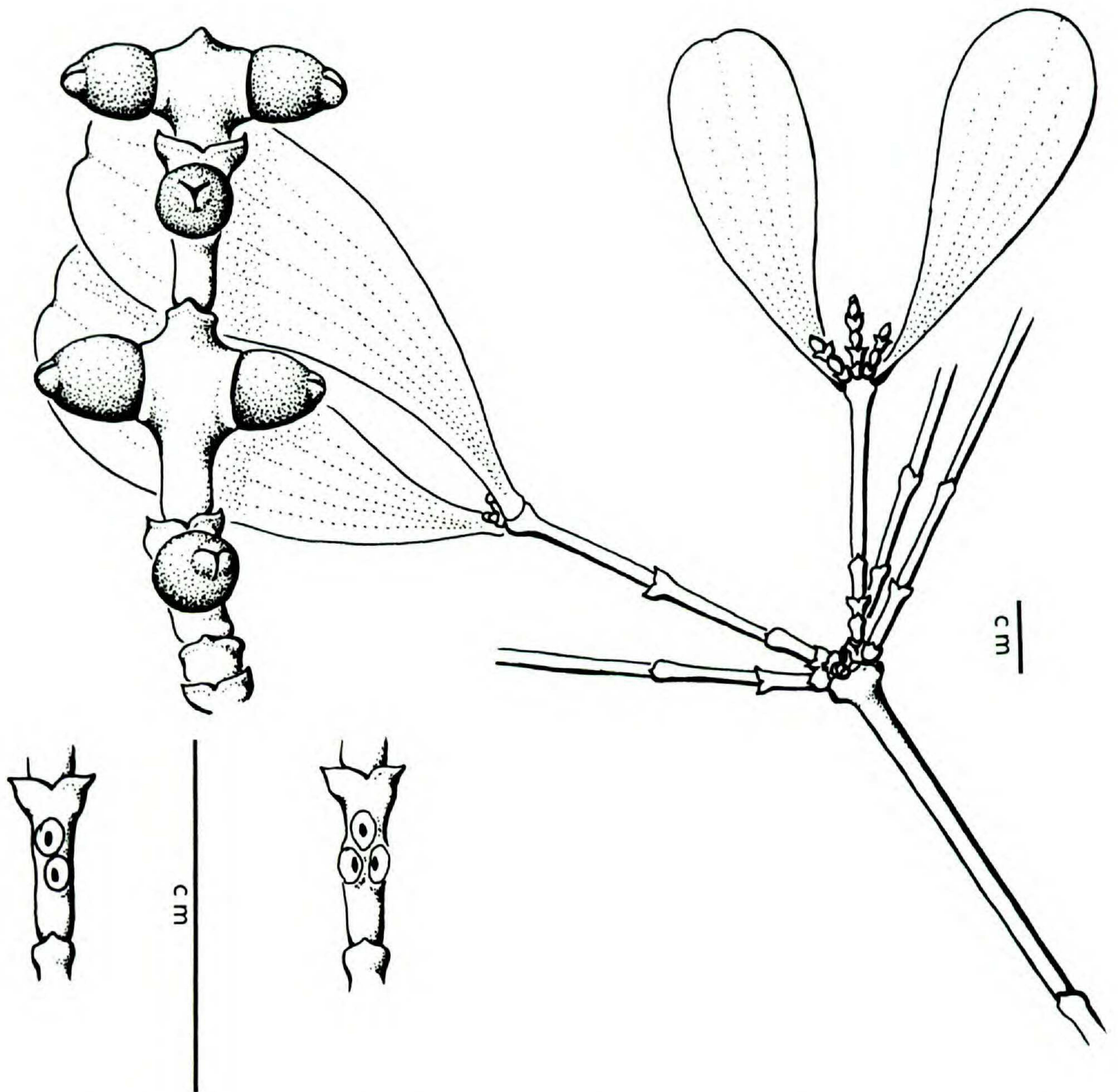


FIGURE 3.—*Phoradendron* sp. No. 16, habit (*Nee 10880*) and inflorescence details (*Nee 7420*).

ture), it is here placed in the former genus because of its forking habit and multiple cataphylls, neither of which feature is known from continental *Dendrophthora*.

CANAL ZONE: Summit Garden, 80 m, *Nee 7420* (MO, LEA). Along Chagres River,  $\frac{1}{2}$  km S of Fort San Lorenzo, sea level, *Nee 10880* (MO, LEA). DARIÉN: Puerto Saint Dorotea, on beach, *Dwyer 2260* (MO).

17. *Phoradendron* aff. *racemosum* (Aubl.) Krug & Urban, Bot. Jahrb. Syst. 24: 46. 1897.

Large plants, the internodes up to 7 cm long, distally compressed when young, soon becoming terete; cataphylls on lateral branches 1 pair, rarely 2 or 3, about 5 mm above base, none on percurrent internodes. *Leaves* to 15 cm

long and 6 cm wide, rather thin, ovate, the venation pinnate, the midvein very prominent below, the petiole ca. 15 mm long, gradually tapering into the base of the blade, the apex rounded. *Spikes* lax or even sinuous, lacking basal cataphylls, the peduncle 5–7 mm long, the internodes to 3 cm long, the bracts with ca. 15 flowers mostly in 2 series, the mature spike up to 9 cm long. *Berries* more or less spherical, 4–5 mm in diameter, the perianth inflexed.

The specimen cited below is undoubtedly related to *P. racemosum* but may not be conspecific with it.

True *P. racemosum* is known from the northerly Caribbean islands and from the French Guyana-Venezuela area (Trelease, 1916). Our Panamanian material differs in having compressed young stems, large berries (4–5 mm, about twice the size of those of true *P. racemosum*), spikes up to 9 cm long, and the fertile internodes longer and with more flowers, mostly in two series. All flowers on the plant seem to be pistillate, while Trelease implies a monoecious condition for *P. racemosum*.

CHIRIQUÍ: Cerro Colorado, along road between San Felix and Cerro Colorado, 2.3 km from turn-off to Escopeta, 1000 m, *Croat 37069* (MO).

#### 18. *Phoradendron* sp.—FIG. 4.

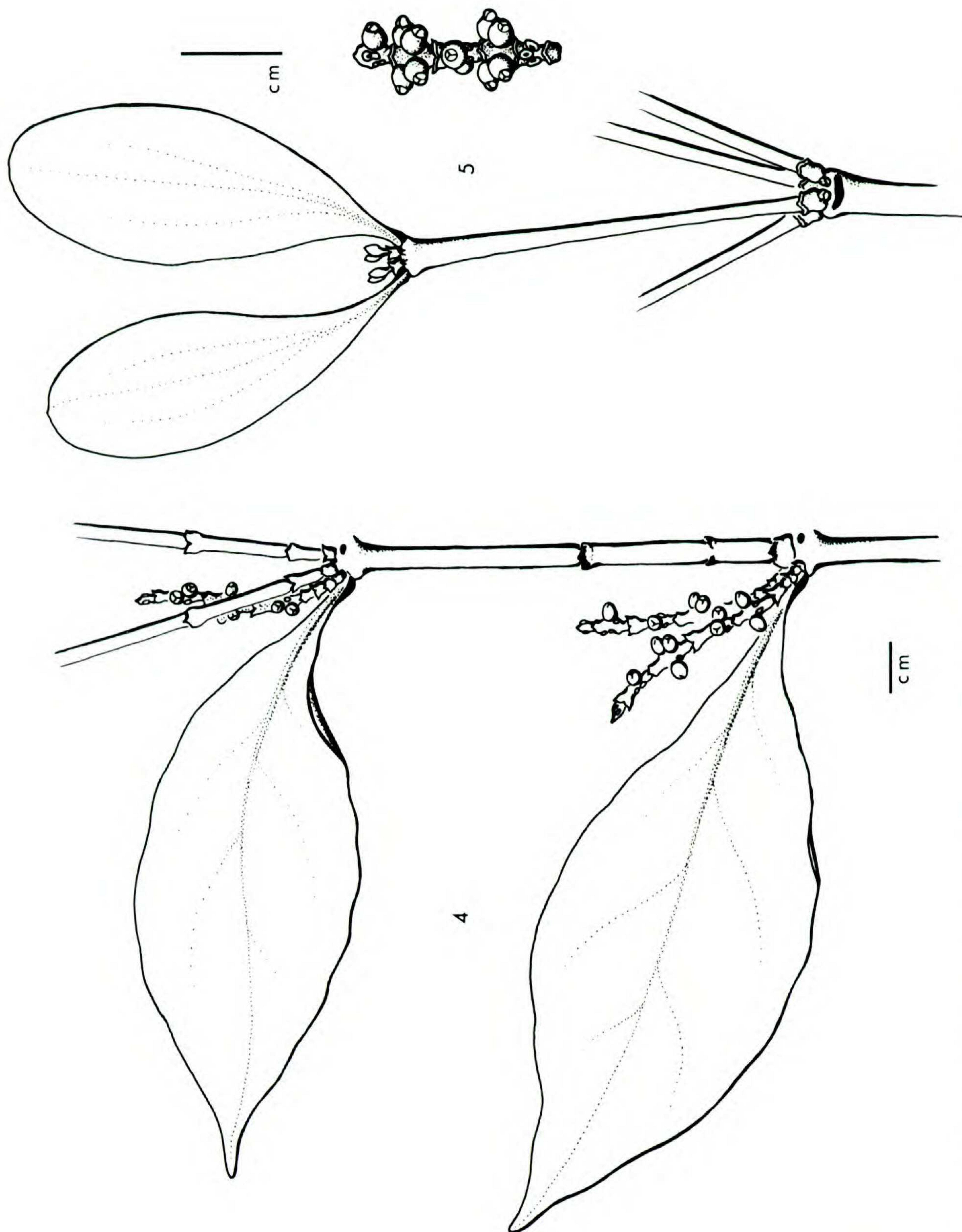
Rather sparsely and teretely branched plants; both percurrent and lateral branches with 3–4 pairs of sterile cataphylls, the branch tips sometimes aborting? *Leaves* rather thick, pinnately but obscurely veined except for the prominent midrib, broadly lanceolate, the apex attenuate, the petiole 10–15 mm long, the blade to 12 cm long and 5 cm wide. Probably *monoecious*. *Spike* ca. 45 mm long, with several short, sterile internodes and 4–5 fertile ones. *Flowers* in 1a and 1b (cf. Kujit, 1936b) arrangement, the apical ones on many internodes apparently staminate, the others pistillate. *Fruit* ovate, 4 mm long, 3 mm wide, the petals closed.

This species seems to be almost exactly intermediate between *P. crassifolium* and *P. piperoides*. It shares the several intercalary cataphylls and proportions of leaves and spikes with the former, but these cataphylls bear no spikes, and leaf venation is not palmate as in *P. crassifolium*. *Phoradendron piperoides*, on the other hand, has only one pair of intercalary cataphylls, is smaller in leaf, petiole, and fruit, and its spikes bear more, but more spherical berries. The only other species with several sterile intercalary cataphylls is *P. woodsonii*. It differs in having leaves no more than half as long as the above, and in having correspondingly shorter internodes; more importantly, leaf venation is clearly palmate, and fruits are more spherical than elliptical. Our material does not seem to be represented in Trelease (1916).

PANAMÁ: Along El Llano Cartí-Tupile road, 12 mi above Pan-Am. Highway, primary forest, 200–500 m, *Liesner 1217* (MO, LEA).

#### 19. *Phoradendron* sp.—FIG. 5.

A much branched, glabrous mistletoe with terete stems, some percurrent,



FIGURES 4-5.—4. *Phoradendron* sp. No. 18 (Liesner 1217).—5. *Phoradendron* sp. No.19 (Dwyer, Crosby, Croat & Castillon 4340).

others forking through apical abortion; percurrent branches lacking cataphylls; lateral branches with a single pair of white-margined cataphylls at the very base. *Leaves* elliptical, to 5 cm long and 2 cm wide, the apex obtuse, the base tapered into a short, flat petiole. Presumably *dioecious*; staminate plant or flowers not seen. *Pistillate spike* ca. 2 cm long, with a single, short sterile internode and 4–5 fertile ones; fertile bracts usually with 3 flowers in 1a arrangement. *Fruit* yellow, round, 2.5 mm wide, the petals closed, the floral cup conspicuous, the apex of the spike blunt.

The pistillate spike provisionally placed in *P. annulatum* in my Costa Rican revision (Kuijt, 1964) is more likely to belong with the present species, as it has fewer flowers per internode than the type. The Panamanian specimen cited below is clearly not related to *P. annulatum*. A peculiarity of this otherwise undistinguished mistletoe seems to be that spikes never develop in the axils of leaves, but only on older wood below. This feature and the terete stems immediately differentiate this species from *P. quadrangulare* with which it otherwise may be confused. The species is probably not included in Trelease's treatment (1916).

PANAMÁ: Road to Campana, near Pan-American Highway, roadside field, *Dwyer et al.* 4340 (MO, LEA).

## 20. *Phoradendron* sp.—FIG. 6.

A glabrous, very stout and coarse plant, often forking through apical abortion; branches terete, to 1.5 cm thick below, the leaf-bearing ones 4–5 mm thick but to 10 mm thick at the leafy nodes; innovations of 2–5 internodes, all but the terminal node bearing pairs of large cataphylls, these more crowded toward the base; percurrent branches similar. Terminal node with extremely leathery elliptical *leaves*, the blade to 10 cm long and 13.5 cm wide, with a thick, callused margin and rounded apex, the base abruptly tapered into a massive petiole 3–5 mm wide, the venation palmate but usually obscure. *Dioecious*. *Pistillate spikes* to 5 cm long, consisting of several sterile, basal internodes and ca. 5 fertile ones with up to 18 flowers per internode in 3 series above each bract. *Staminate plants* not seen.

This very distinctive species has not been previously reported from Central America. It is related to *P. obliquum*, differing in having consistently more cataphylls on both innovations and inflorescences, in having symmetrical rather than falcate leaves, and in being apparently dioecious. The original description of *P. fendlerianum* Eichler (Eichler, 1868) appears to match our material; the type specimen was destroyed at Berlin-Dahlem, but its photograph survives in Trelease's monograph (1916: pl. 211b).

PANAMÁ: Cerro Jefe, 1000 m, *Mori et al.* 3766 (MO, LEA); 2700–3000 ft, *Tyson et al.* 3193 (MO), 3282 (MO), 4340 (MO, LEA). VERAGUAS: 3–4 km by road W of Santa Fé, 2500 ft, *Nee* 11316 (MO, LEA).

8. PHTHIRUSA Eichler, Fl. Bras. 5(2): 52. 1868, non Mart. in Schult. & Schult., Syst. Veg. 7: 96. 1829.



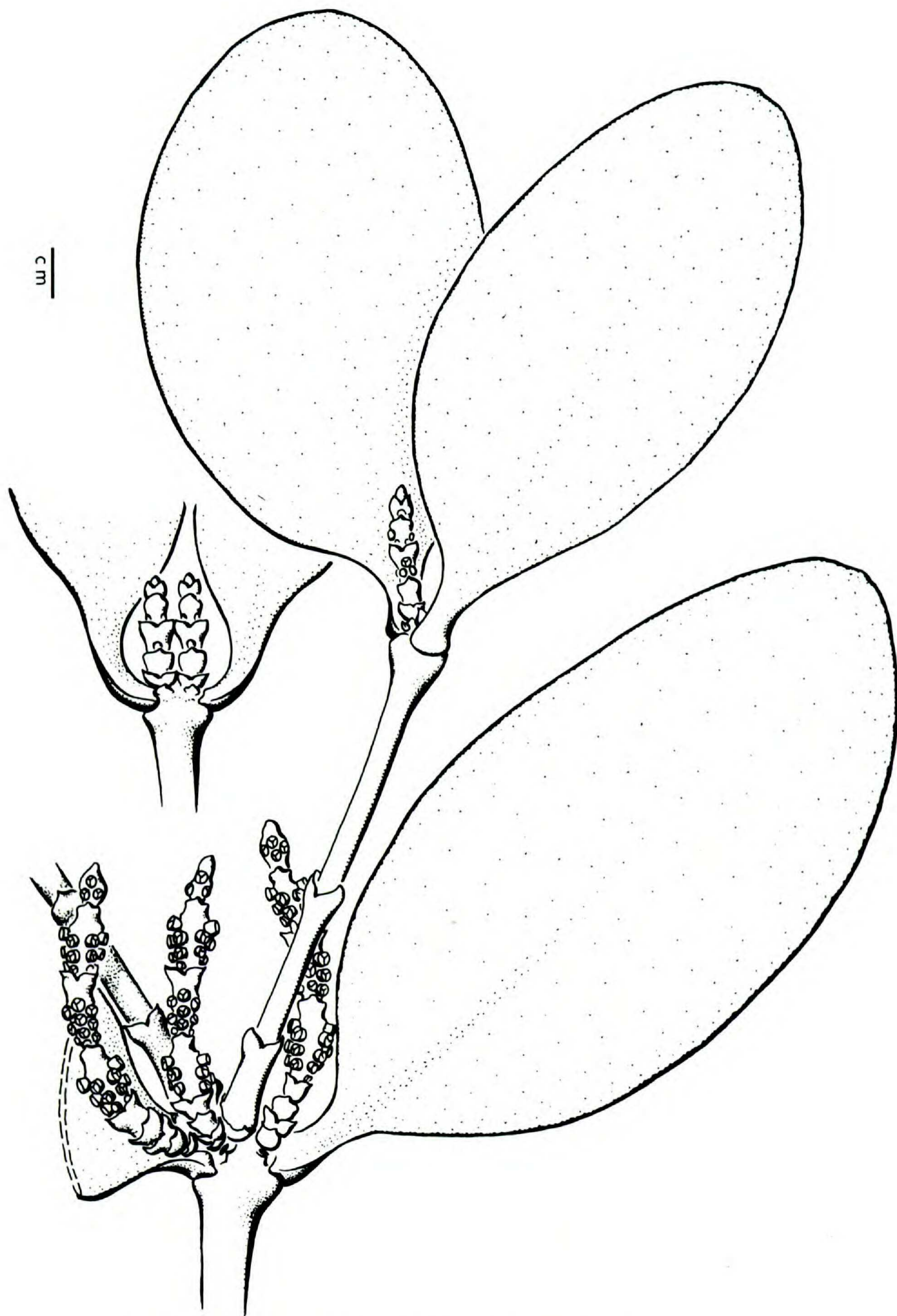


FIGURE 6.—*Phoradendron* sp. No. 20 (Mori & Kallunki 3766).

A rather large genus of uncertain distinction from *Struthanthus*, with two species in Panama. One of these is the type species, *P. pyrifolia*, the only *Phthirusa* north of Panama, reaching southern Mexico. In Rizzini's (1960) treatment no mention is made of the fact that many (if not most) species of *Phthirusa*, including the type species, have hermaphroditic flowers. However, there are some close relatives of *P. pyrifolia* which are dioecious, so that sex distribution alone cannot be used as a generic distinction. The other Panamanian species, *P. adunca*, is such a dioecious one. A third species mentioned by Rizzini (1960), *P. pittieri*, becomes a synonym of *Struthanthus leptostachyus*.

Critical literature: Rizzini, 1952; Kuijt, 1976b, Kuijt & Weberling, 1972.

- a. Plants dioecious; flowers at least 4 mm long, pale yellow; inflorescence usually branched ..... 1. *P. adunca* (Meyer) Maguire  
 aa. Plants with the flowers hermaphroditic; flowers less than 3 mm long, dark wine red; inflorescence an unbranched spike or raceme ..... 2. *P. pyrifolia* (H.B.K.) Eichler

1. ***Phthirusa adunca*** (Meyer) Maguire, Bull. Torrey Bot. Club 75: 301. 1948.

This species reaches its northern limits in Panama, being very common in tropical South America.

2. ***Phthirusa pyrifolia*** (H.B.K.) Eichler, Fl. Bras. 5(2): 36. 1868.

While *P. adunca* develops roots on some branches, *P. pyrifolia* never does so. Both species, however, produce long roots with secondary haustoria from the base of the plant. The ovary of this species is solid, i.e., no ovarian cavity exists, the embryo sacs developing in the central parenchymatous tissues. Other anatomical peculiarities and a case for habitual autogamy in this mistletoe are presented by Kuijt & Weberling (1972). It is entirely possible that some of these unusual features are shared by related species or even the genera *Dendropomon* and *Oryctanthus*. Barlow & Wiens (1971) have found only tetraploids in Costa Rica, but only diploids in Ecuador, so that both chromosome races could conceivably occur in Panama.

9. **PSITTACANTHUS** Mart., Flora 13: 106. 1830.

This is the only large-flowered genus in Central America with flowers which are at least partly red; the only other large, brightly colored mistletoe flowers in the area are the golden yellow ones of *Gaiadendron*. The genus is distributed from northern Mexico far into South America, with species on Jamaica, Martinique, and Dominica.

Critical literature: Eichler, 1868.

- a. Leaves lacking petioles, the base clasping the stem; lower inside petals with vermiform marginal appendages ..... 3. *P. hamulifer* Kuijt  
 aa. Leaves petiolate; petals without vermiform marginal appendages.  
 b. Inflorescence axillary or on older wood, the smallest unit a pair of flowers (diad); leaves mostly symmetrical.  
 c. Leaves usually in whorls of 4 (sometimes paired); anthers nearly sessile, monomorphic, backed by a tuft of long, red hairs .....  
 ..... 4. *P. nodosus* (Desr.) G. Don

- cc. Leaves 2 or 3 per node, or irregularly spaced, rarely in whorls of 4; anthers on long filaments, dimorphic, hairless.
- d. Flowers dilated at the base; leaves 7 cm long or more; petals not plicate ..... 1. *P. allenii* Woods. & Schery
- dd. Flowers scarcely dilated at the base; leaves 6 cm long or less; petals plicate at the tip ..... 5. *P. pusillus* Kuijt
- bb. Inflorescence terminal, the smallest unit a triad; leaves falcate or at least tending to be asymmetrical.
- e. Mature buds 8–9 cm long, straight; leaves usually more than 6 cm wide ..... 6. *P. schiedeanus* (Cham. & Schlecht.) Blume
- ee. Mature buds about 4 cm long, slightly curved; leaves usually less than 5 cm wide ..... 2. *P. calyculatus* (DC.) G. Don

1. ***Psittacanthus allenii*** Woods. & Schery, Ann. Missouri Bot. Gard. 27: 309. 1940.

*P. lateriflorus* Woods. & Schery, Ann. Missouri Bot. Gard. 27: 309. 1940.

*P. scheryi* Woods., Ann. Missouri Bot. Gard. 28: 426. 1941.

The ligular differences to separate the above are not thought to warrant any taxonomic recognition. *Psittacanthus allenii* is also extremely variable in its leaf shape and size. It has been collected in southern Mexico, Nicaragua, Costa Rica, and Panama. The closest relative of *P. allenii* seems to be *P. dilatatus* A. C. Smith, the latter having much thicker buds and 1–1.5 mm long, erect, strap-shaped ligules. Additionally, the stigma is situated below the anthers in *P. dilatatus*, but above the anthers in *P. allenii*. Another closely related species is *P. dichrous* (Mart.) Mart., of which authentic material has not been seen; the excellent illustration in the *Flora Brasiliensis* 5(2), pl. 8. 1868 shows a crenulate calyculus which *P. allenii* lacks. I have elsewhere remarked on the unusual fact that seedlings of *P. allenii* in some areas are dicotyledonous, in others polycotyledonous (Kuijt, 1970).

2. ***Psittacanthus calyculatus*** (DC.) G. Don, Gen. Syst. 3: 415. 1834.

*P. chrismarii* Urban, Bot. Jahrb. Syst. 24: 311. 1897.

Like *P. schiedeanus*, which it resembles somewhat, *P. calyculatus* ranges north to southern Mexico but, unlike the former species, it also occurs in Colombia and Venezuela. In the Costa Rica-Panama area, all known collections are from the Pacific slopes. While the two species are somewhat similar, the leaf and bud characters used in the key provide a clear separation.

3. ***Psittacanthus hamulifer*** Kuijt, sp. nov.—FIG. 7.

Planta sat robusta; caules paulus applanati nec costati; internodia usque ad 10 cm longa. Folia coriacea, usque ad 15 × 7 cm, pinnatinervia, ovata ad late lanceolata, basi cordata, amplexicaulia, apice acuta. Flores ut videtur in diadis; pedunculo pedicelloque circ. 5 mm longis, gracillimis; calyculus margine crenatus; petala 5 cm longa, alabastro anguste acutato, recta, laete aurantiaca, apice lutea; facies interior inferne (3 cm) seriebus marginalibus appendicum vermiformium duabus, supra eas stamina 1.5 cm longa inserta; antherae 4.5 mm longa, acumine aciformi 1 mm longo auctae, versatiles; stylus petala fere aequans; stigma breviter clavatum, papillosum.

Stems only very slightly flattened, the internodes to 10 cm long. *Leaves* coriaceous, to 15 cm long and 7 cm wide, pinnately veined with a very prominent

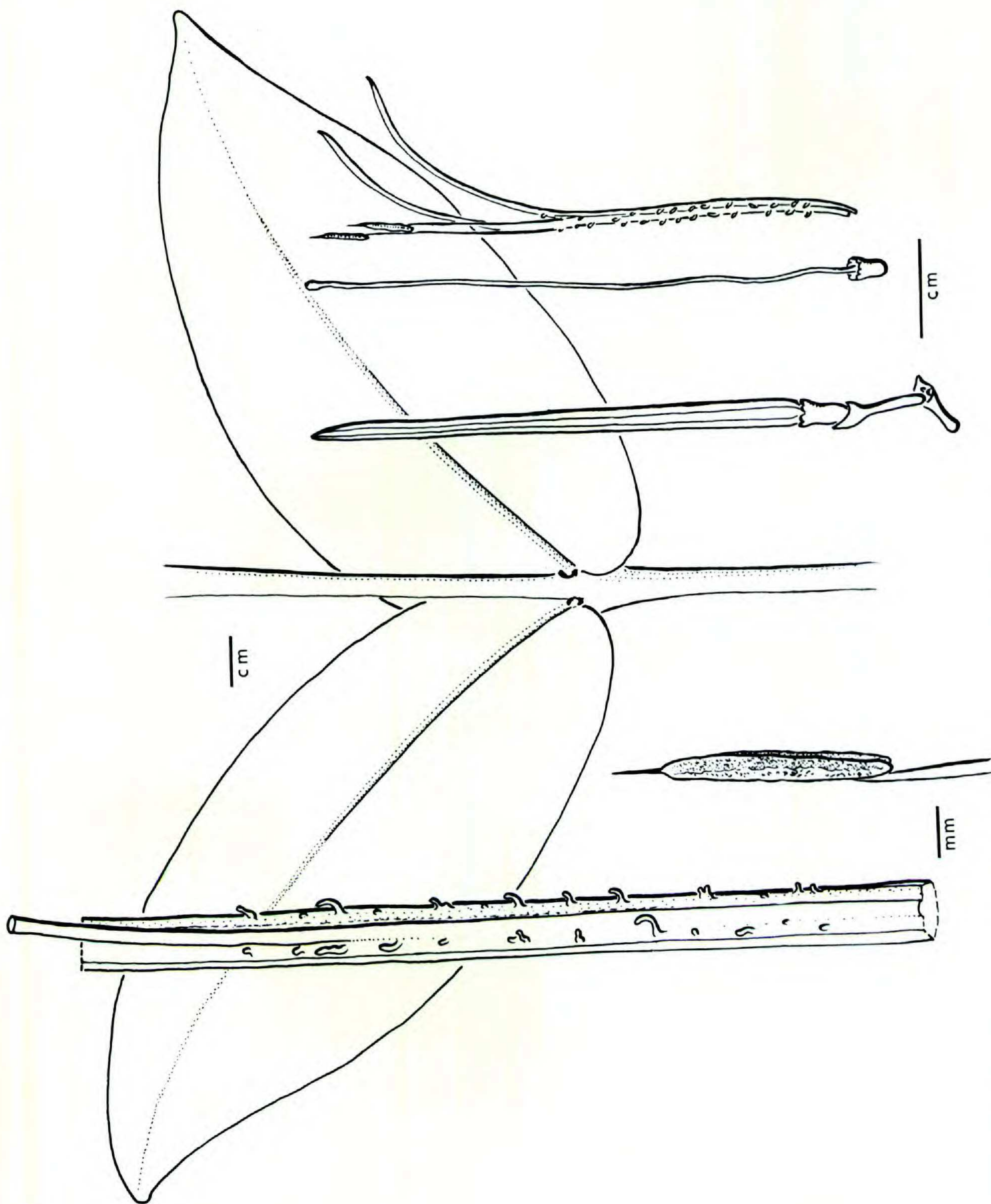


FIGURE 7.—*Psittacanthus hamulifer* Kujit (Duke & Elias 13681), habit and floral details.

midvein, ovate to broadly lanceolate, the base cordate and clasping, the apex acute. *Flowers* (? only) in axillary positions, emerging from a "cushion" as in *Cladocolea* (cf. Kuijt, 1975), apparently in diads; peduncle about 5 mm; pedicel slightly longer, very slender, terminating in an oblique cup; petals 5 cm long, very narrowly pointed in the straight bud, bright orange with a yellow tip, with 2 rows of fleshy, hook-shaped, marginal, frequently paired appendages up to 0.5 mm long inside for the lowest 3 cm, at which point filaments attached; stamens 1.5 cm long, the anthers 4.5 mm, narrow, versatile, with a needlelike tip about 1 mm long, and of 2 different lengths; ovary 4 mm long, 3 mm wide at the irregularly scalloped calyculus; the style more or less straight, nearly the length of the flower, the stigma papillate, clavate. *Fruit* not seen.

This is an exceedingly interesting species because of its flower structure. The hooklike or vermiform appendages in what appears to be the tubular portion of the corolla may either function in holding the nectar (see the comparable internal corolla modifications in the African *Plicosepalus* and *Tapinostemma* as illustrated in Engler & Krause, 1935: figs. 70–71); or possibly, as their marginal position suggests, in linking the petals together. One other species (*Psittacanthus peronopetalus* Eichl.) has been reported with similar appendages (Eichler, 1868), but that species differs in having petioled leaves, a prominent ligule, apically diverging petals, and anthers lacking the needlelike tip.

TYPE: PANAMA. DARIÉN: On tree trunk in elfin forest, Cerro Pirre, cloud forest and/or mossy forest, 2500–4500 ft, *Duke & Elias 13681* (MO, holotype; DUKE, SCZ, isotypes).

#### 4. *Psittacanthus nodosus* (Desr.) G. Don, Gen. Syst. 3: 417. 1834.—FIG. 8.

*Loranthus nodosus* Desr. in Lam., Encycl. 3: 601. 1809.

*Desrousseauxia nodosa* (Desr.) Van Tieghem, Bull. Soc. Bot. France 42: 358. 1895.

*Aethanthus nodosus* (Desr.) Engler, in Engler & Prantl, Nat. Pflanzenfam., Nachtr. 1: 136. 1897.

Stems terete, the nodes swollen, the internodes up to 12 cm long. *Leaves* in regular whorls of 4 (sometimes paired), to 8 cm long and 4 cm wide, rarely to three times this size (*Mori 8005*), ovate or obovate to broadly lanceolate, with a rough texture when dry. *Inflorescences* axillary, apparently consisting of several diads on a common, red peduncle. *Flowers* bright red or orange below, yellow above, 4–6 cm long in bud, the buds rounded at the apex, straight; calyx scarcely or not at all dilated at the base; anthers all inserted at the same height, 5 mm below the petal tips, nearly sessile and backed by a crescent of long reddish hairs; ovary 4 mm long, the style straight, with a small clavate stigma just beyond anthers. *Fruit* dark purple, ca. 9 mm long and 5 mm wide, with an inconspicuous calyculus.

The Central American material corresponds rather closely both to the original description and to the Jussieu type at Geneva, collected in Ecuador, notwithstanding the latter's more broadly ovate leaves. It should be noted, however, that there is no mention in the original description of hairs associated with the anthers.

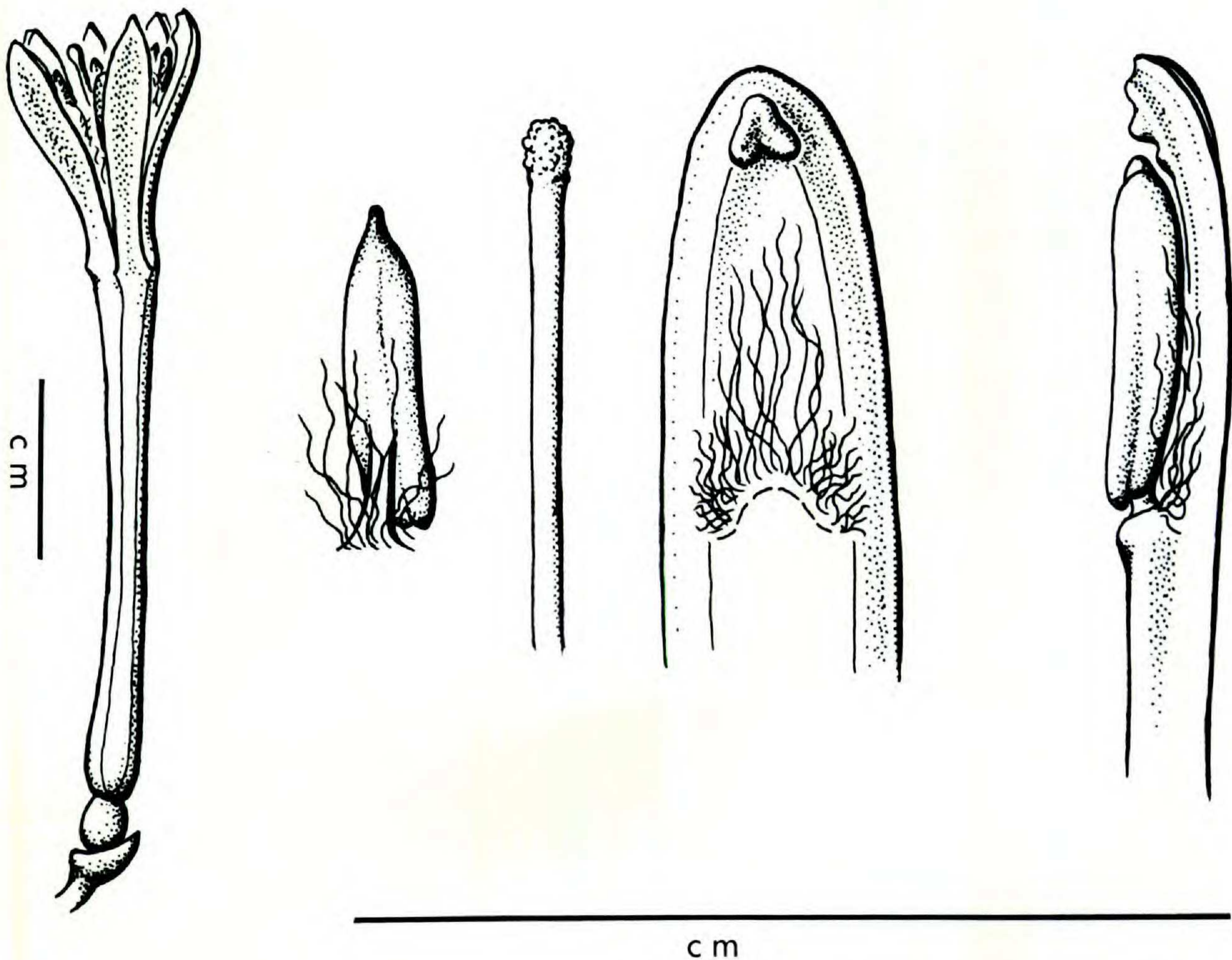


FIGURE 8.—*Psittacanthus nodosus* (Desr.) G. Don (*Luteyn & Foster 1122*). From left to right: flower; anther as seen from the back; tip of style; petal tip with anther removed (broken line); and anther and petal tip from the side.

The species is also known from Costa Rica where it was treated as an unidentified species (No. 29) of *Psittacanthus* (Kuijt, 1964).

A specimen of uncertain identity is *Gentry & Mori 14140* [Darién, central ridge of Cerro Tacarcuna massif, 1700–1800 m (MO)]. It resembles the present species except that the buds are slightly curved and unusually stout.

CHIRIQUÍ: Nubes, 5.5 km NW of Río Chiriquí Viejo, 2200 m, *Busey 661* (MO). Las Nubes, 5 km NW of Cerro Punta, 6000–6500 ft, *Mori & Bolten 7233* (DUKE); *Croat 26473* (MO, LEA). Río Chiriquí Viejo, 2 km NE of Guadalupe which is 2 km N of Cerro Punta, *Wilbur et al. 15368* (DUKE, MO). COCLÉ: El Valle de Antón: *Allen 2233* (US). El Valle de Antón, La Mesa, *Croat 14381* (MO). El Valle de Antón, Cerro Pilon, 2000 ft, *Dwyer & Correa 7995* (MO). COLÓN: La zona de Santa Rita, *Correa & Dressler 1816* (MO). DARIÉN: Colombia (Chocó)-Panama (Darién) border, slopes of Serrania del Darién E of Ungía, 300–1300 m, *Gentry et al. 16774* (MO). PANAMÁ: 8 km above Goofy Lake on road to Cerro Jefe, *Correa & Dressler 477* (MO). 1 mi beyond La Eneida, Cerro Jefe, *Correa & Dressler 971* (MO). Cerro Jefe, *D'Arcy & D'Arcy 6248* (MO); *Dwyer & Gauger 7334* (MO); *Dwyer & Hayden 8088* (MO); *Gentry 6166* (MO); *Gentry & Dwyer 5538* (MO). Near La Eneida, 100 m, *Luteyn & Foster 1122* (DUKE, MO). Cerro Jefe, 1000 m, *Mori 8005* (MO); *Mori & Kallunki 3631* (MO). Above Goofy Lake on road to Cerro Jefe, *Weaver & Foster 1496* (DUKE). VERAGUAS: 7 km NW on road to Santa Fé, *D'Arcy 10285* (MO). 3–5 mi N of Santa Fé, 500–1000 m, *Gentry 2956* (MO). N of Santa Fé, *Mori & Kallunki 2599* (MO). 3–4 km W of Santa Fé, 2500 ft, *Nee 11318, 11320* (both MO).

5. *Psittacanthus pusillus* Kuijt, sp. nov.—FIG. 9.

Frutex parvus, gracilis; caules teretes; flores bini axillares, innovationibus ex internodiis 1–4 constantibus insidentes. Folia bina vel fere, elliptica ad late lanceolata, usque ad 6 × 2.5 cm, petiolis 1–3 mm longis. Diadae singulae in axillis; pedicelli 8–10 mm longi, cupula ampliata terminati. Flos 30–40 mm longus; corolla 27–30 mm longa, recta vel paulum curvata, aurantiaca, apice luteo vel viridescente; petala apice conspicue plicata, ligula minuta; stamina dimorpha, ante anthesim haud imbricata.

A small and slender species, the stems terete and smooth with fine longitudinal cracks in age, ca. 2 mm thick when flower bearing. *Leaves* paired but sometimes irregularly spaced, elliptical to broadly lanceolate, to 6 cm long and 2.5 cm wide, the petiole 1 mm thick and 1–3 mm long, the apex rounded, the base tapering into the petiole, only the midvein visible when dry. *Flowers* axillary only, only on innovations 1–4 internodes long, in diads (rarely a triad), these 1 per leaf axil, 3–4 cm long; peduncles 3–7 mm long, ca. 1 mm thick, often consisting of 2 internodes lacking leaves, emerging from a craterlike axillary rim of brown tissue; pedicels 8–10 mm long, ca. 1 mm thick, terminating in a flaring cuplike structure 4 mm wide; corolla 27–30 mm long; the corolla tube straight or slightly curved, 3–4 mm wide at the rounded tip, scarcely dilated below, said to be orange with yellow or with a greenish apex, the petals conspicuously plicate at the tip, 6, the ligule very small; stamens dimorphic, slightly shorter than the petals, the anthers versatile, 3 mm long, not overlapping in bud, the filaments 12–15 mm long; ovary globose, ca. 3 mm in diameter, the calyculus smooth, the style slender, 25 mm long, the stigma small, elliptical, with finely papillate surface. *Fruit* unknown.

The closest relative of this species may be the Ecuadorian *P. obovatus* (Benth.) Eichler which is similarly small leaved but has terminal inflorescences. I know of no other *Psittacanthus* flowering by means of such leafy innovations.

TYPE: PANAMA. PANAMÁ: In forest, about 1 mi upstream from Frizzel's Finca Indio, on slopes of Cerro Jefe, *Foster & Kennedy 1863* (DUKE).

Other material seen: PANAMÁ: Cerro Jefe, 2.5 mi beyond Finca Indio, *Gentry 2108* (MO). Road past Cerro Azul, 20 km from junction with road through Tocumen, *Mori & Kallunki 2192* (MO). 8 km above Goofy Lake on road to Cerro Jefe, *Weaver & Foster 1499* (DUKE).

6. *Psittacanthus schiedeanus* (Cham. & Schlecht.) Blume in Schult. & Schult., Syst. Veg. 7: 1730. 1830.

10. STRUTHANTHUS Mart., Flora 13: 102. 1830.

This is perhaps the most difficult genus in neotropical Loranthaceae, at least in part because it seems to be polyphyletic (Kuijt, 1975). Especially the plants in the *marginatus-quercicola* complex are often difficult to identify. In this regard, the present treatment is little more than an extrapolation of my Costa Rican treatment (1964).

Critical literature: Eichler, 1868; Kuijt, 1964.

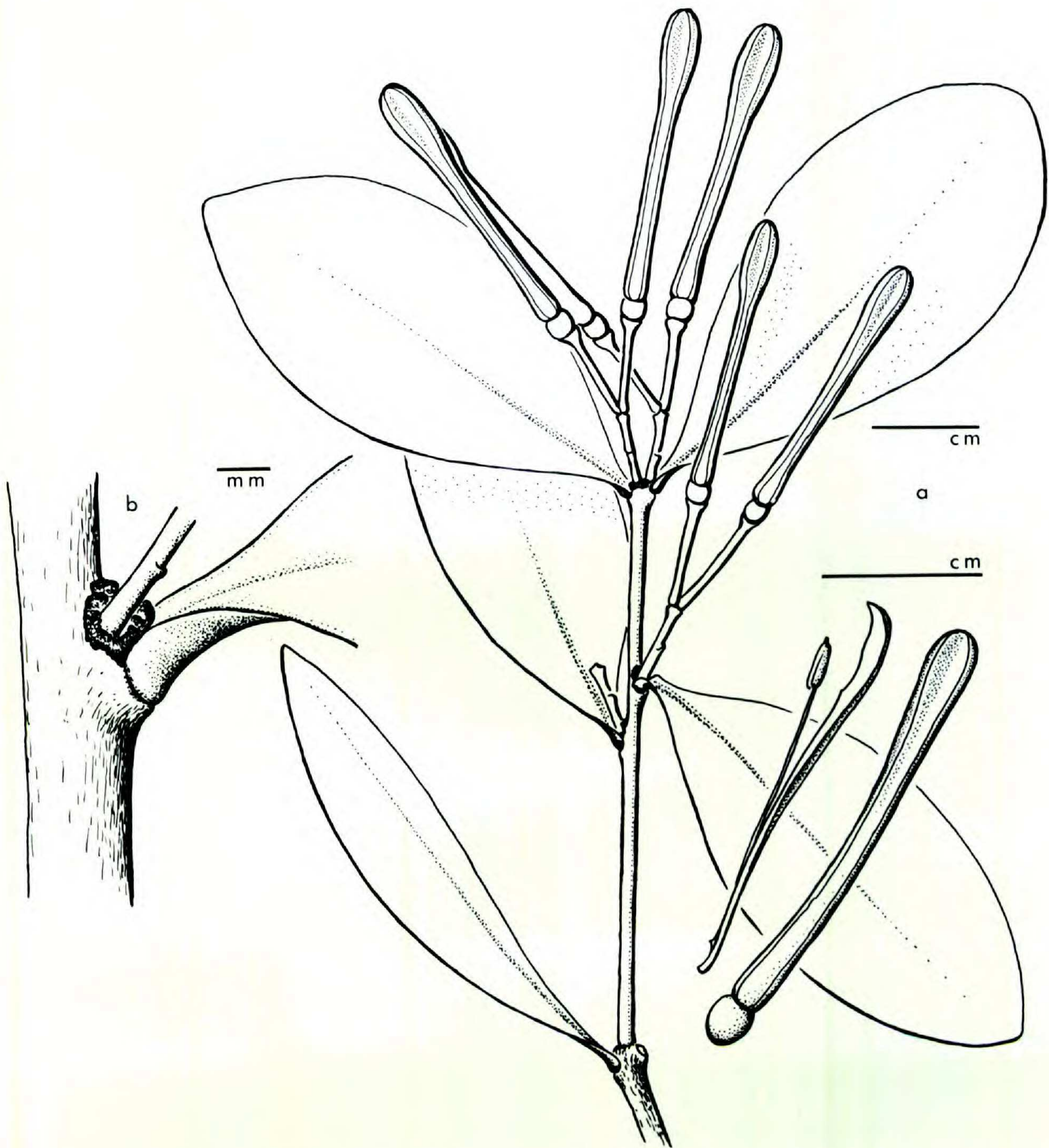


FIGURE 9.—*Psittacanthus pusillus* Kuijt, type (Foster & Kennedy 1863).—a. Habit and floral details.—b. Axillary cushion at base of diad.

- a. Each flower supported by 1 bract and 2 bracteoles, these monads paired along the raceme axis ..... 5. *S. panamensis* (Rizz.) Barlow & Wiens
- aa. Flowers in triads, these with 1 bract and 2 bracteoles and paired along the raceme axis.
- b. Stem (often also inflorescence axis) dotted with large lenticels; inflorescence subtended by persistent papery bracts ..... 2. *S. leptostachyus* (H.B.K.) G. Don
- bb. Stems lacking obvious lenticels; inflorescence without persistent papery bracts.
- c. Bracteoles of female flowers stout and persistent.
- d. Mature fruit dark blue, more than 7 mm long; some young leaves prehensile ..... 7. *S. rotundatus* Rizz.
- dd. Mature fruit reddish orange, less than 7 mm long; leaves never prehensile ..... 6. *S. quercicola* (Cham. & Schlecht.) Blume



- cc. Bracteoles of female flowers delicate and deciduous.
  - e. Young leaves prehensile, on somewhat quadrangular stems; fruit blue when mature, at least 1 cm long, on swollen pedicel with lenticels ..... 4. *S. orbicularis* (H.B.K.) Blume
  - ee. Young leaves not prehensile, on terete stems; fruit reddish to yellow, less than 1 cm long, the pedicel not conspicuously swollen.
    - f. Inflorescence axis very delicate, sometimes with no more than 4 triads; triad peduncle 2–3 mm long; fruit 5 mm long, 3 mm wide; leaves commonly 3 or more times as long as wide, with a very attenuate apex ..... 1. *S. aff. dichotrianthus* Eichler
    - ff. Inflorescence axis not particularly delicate, always with more than 6 triads; triad peduncle 2 mm long or less; fruit 7 mm long, 5 mm wide; leaves usually less than 3 times as long as broad, the apex not or scarcely attenuate ..... 3. *S. marginatus* (Desr.) Blume

### 1. *Struthanthus* aff. *dichotrianthus* Eichler, Fl. Bras. 5(2): 75. 1868.

Scandent *shrub* with terete stems and stem-roots. *Leaves* paired, thin, 7–11 cm long, 1.5–4.5 cm wide, including a 2–5 mm, tapering petiole, the blade ovate to lanceolate, with a slender, attenuate tip. *Inflorescence* very slender, 1 or 2 per axil; peduncle up to 1 cm long, with 2 or 4(–10) triads each on peduncle of similar length. *Flowers* not seen. *Fruit* oblong to spherical, to 4 mm long and 5 mm wide, yellow to bright orange, the median one sessile, the lateral ones on pedicels nearly 2 mm long.

It is possible that this material corresponds to what has been referred to as *Struthanthus* No. 37 (Kuijt, 1964); certainly Fig. 37 in that article illustrates the habit of the Panamanian material. The D'Arcy collection is very narrow-leaved, and its inflorescences are also more elongate than the Coclé material. Finally the Luteyn collection has up to 10 triad pairs per inflorescence. Whether all this material [plus the *von Wedel* 1287 (GH) mentioned in Kuijt (1964: 301)] constitutes a single variable species, or whether all are variants of *S. marginatus* remains an open question.

BOCAS DEL TORO: Between Buena Vista coffee finca and Cerro Pilon, *Kirkbride & Duke* 709 (LEA, MO). COCLÉ: Foothills of Cerro Pilon, near El Valle, 900 m, *Duke & Correa* 14673 (MO). Cerro Caracoral, 900 m, *Duke & Dwyer* 15131 (MO). La Mesa, above El Valle, *Dwyer* 11862 (LEA, MO). Foot of Cerro Pilon, above El Valle de Antón, 2000 ft, *Porter et al.* 4409 (LEA, MO). VERAGUAS: 7 km NW on road to Santa Fé, *D'Arcy* 10280 (MO). ? NE slopes of Cerro Delgadito, just NW of Cerro Tuté, S of town of Santa Fé, 1000 m, *Luteyn* 4024 (DUKE).

### 2. *Struthanthus leptostachyus* (H.B.K.) G. Don, Gen. Syst. 3: 411. 1834.

*Loranthus leptostachyus* H.B.K., Nov. Gen. Sp. Pl. 3:440. 1818.

*L. pyrifolius* Willd. in Schult & Schult., Syst. Veg. 7: 1647. 1830, non H.B.K.

*Peristethium leptostachyum* (H.B.K.) Van Tieghem, Bull. Soc. Bot. France 42: 175. 1895.

*Phthirusa pittieri* Krause, Repert. Spec. Nov. Regni Veg. 15: 441. 1919.

This species is not to be confused with: *Viscum leptostachyum* Spreng. in DC., Prodr. 4: 280. 1830 = *Dendrophthora leptostachya* (Spreng.) Eichler, Fl. Bras. 5(2): 104. 1868 = *Phoradendron leptostachyum* (Spreng.) Index Kew. 3: 502. 1894 = *Dendrophthora flagelliformis* (Lam.) Krug & Urban.

This common species has frequently been referred to as *S. polystachyus* (Ruiz & Pavón) Blume, as in Rizzini's (1960) and my own (Kuijt, 1964) treatments.

The type of *Loranthus polystachyus* Ruiz & Pavón, however, has leaves which are consistently different in shape from Central American material, which almost certainly is specifically distinct. In Central America this mistletoe is unique in having a cluster of persistent, papery scale leaves which invests the base of each inflorescence, and in the fact that the tip of the inflorescence, instead of the usual triads of flowers, has single flowers, and even terminates in a single flower (Kuijt, 1964). On the basis of the scale leaves (and supposed hermaphroditic flowers: the flowers are in reality unisexual, the plants dioecious as elsewhere in *Struthanthus*), Van Tieghem (1895) erected the monotypic genus *Peristethium*. *Struthanthus leptostachyus* appears to be closely related to *Cladocolea archeri* (A. C. Smith) Kuijt, confronting us with a nettly taxonomic problem at the generic level (Kuijt, 1975). In the limited sense, this species ranges from Costa Rica as far as Ecuador.

The collection *Tyson et al.* 3233 [Panamá, Cerro Jefe in *Clusia* forest, 2700–3000 ft (MO)] is a very small-leaved specimen. Its relationship to *S. leptostachyus* is clear, but it may represent an undescribed species.

3. ***Struthanthus marginatus* (Desr.) Blume in Schult. & Schult., Syst. Veg. 7: 1731. 1830.**

Equivalence of Central American *S. marginatus* to the type material from eastern Brazil is by no means certain, but cannot be ascertained at this time.

4. ***Struthanthus orbicularis* (H.B.K.) Blume in Schult. & Schult., Syst. Veg. 7: 1731. 1830.**

This is one of several species of *Struthanthus* which uses its young leaves in a prehensile fashion. It is not synonymous with *S. rotundatus* as previously indicated (Kuijt, 1964). This species ranges from southern Mexico into Brazil and Peru. See comments under *S. rotundatus*.

5. ***Struthanthus panamensis* (Rizz.) Barlow & Wiens, Brittonia 25: 39. 1973.**

*Phrygilanthus panamensis* Rizz., Ann. Missouri Bot. Gard. 47: 270. 1960.

This enigmatic species had earlier been thought to be related to *Phrygilanthus palmeri* Watson which, however, was relegated to *Psittacanthus* by Barlow & Wiens (1973). The indicated affinity is out of the question, but the generic status of the species remains uncertain. It might be added that the genus *Phrygilanthus* has been totally dissolved for nomenclatural and other taxonomic reasons (Barlow & Wiens, 1973). The present species may be out of place in *Struthanthus* because of its apparently hermaphroditic flowers and the one-flowered inflorescence unit rather than the triads of other species of *Struthanthus*.

CHIRIQUÍ: Bajo Chorro, Boquete District, 1800 m, *Davidson* 431 (US, holotype; A, F, isotypes); *Davidson* 392 (US). NE ridge leading to Cerro Horqueta, 1800–1900 m, *Luteyn* 3786 (DUKE). Cerro Colorado, 50 km N of San Felix, 1200–1500 m, *Mori & Dressler* 7825 (MO). Chiriquí Viejo ca. 2 mi NE of Cerro Punta, 7000 ft, *Wilbur & Teeri* 13109 (DUKE).

6. **Struthanthus quercicola** (Cham. & Schlecht.) Blume in Schult. & Schult., Syst. Veg. 7: 1731. 1830.

Scandent green *shrub* with epicortical roots, the stems smooth but often somewhat ridged when young, grey. *Leaves* petiolate, ca. 10 cm long and 4 cm wide, ovate, usually thin, the apex attenuate. *Inflorescences* 1–6 per axil, to 50 cm long, then with about 36 flowers in triads with 2–3 mm long stalks; median flower sessile, the lateral ones nearly so; bracts persistent in pistillate flowers, becoming somewhat fleshy in fruit, deciduous at least in some staminate flowers. *Flowers* light green or yellowish, 4 mm across when expanded; petals 2 mm long; stamens shorter, dimorphic, the anthers brownish yellow; style 2 mm long. *Fruit* an orange berry, elliptical to ovoid, 4 mm long, 6 mm wide, supported by somewhat swollen, short pedicels (lateral flowers) or sessile (median flower).

The species is based on a type from Mexico (Jalapa) and is especially common in Costa Rica (Kuijt, 1964). Some of the collections cited earlier (Rizzini, 1960) under *S. marginatus* in reality belong here. Only some representative specimens are cited below.

BOCAS DEL TORO: Along RR near station at Milla 10, *Croat 16339* (LEA, MO). CHIRIQUÍ: Along Río Chiriquí Viejo just above Guadalupe, *Croat 16036* (LEA, MO). E slope of Volcan de Chiriquí (Baru), 2200–2300 m, *Davidse et al. 10185* (LEA, MO). Cerro Respinga, E of town of Cerro Punta, 2000–2500 m, *Gentry 5944* (LEA, MO). W side of Cerro Horqueta, 1700–1800 m, *Luteyn 3759* (DUKE). 2 km W of La Garita about 3 km WNW of Cerro Punta, 2000 m, *Wilbur et al. 15286* (DUKE). Ca. 6 mi NW of Boquete, 1450 m, *Wilbur et al. 11970* (DUKE). DARIÉN: S slope of westernmost peak of Cerro Tacarcuna massif, 1100–1300 m, *Gentry et al. 16874* (MO). LOS SANTOS: 4 mi S of Limón, *Correa et al. 68* (MO). VERAGUAS: N of Santa Fé, on property of Escuela Agrícola Alto de Piedra, *Mori & Kallunki 2606* (LEA, MO).

7. **Struthanthus rotundatus** Rizz., Revista Brasil. Biol. 10: 401. 1950.

This is a clearly distinct species which I erroneously referred to *S. orbicularis* (Kuijt, 1964), to which it is nevertheless closely related. The young leaves are prehensile as in *S. orbicularis*. The two species may be separated in that *S. rotundatus* is generally larger in habit and inflorescences; this species has conspicuous floral bracts and bracteoles which persist in fruit, while those of *S. orbicularis* are small and caducous; the fruiting peduncles of *S. orbicularis* are greatly swollen and show large lenticels, those of *S. rotundatus* are not so swollen and lack lenticels. Finally, the mature fruits of *S. rotundatus* are said to be orange while those of *S. orbicularis*, even though passing through a brick red phase, are dark blue when ripe. The present species was originally described from Brazil.

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